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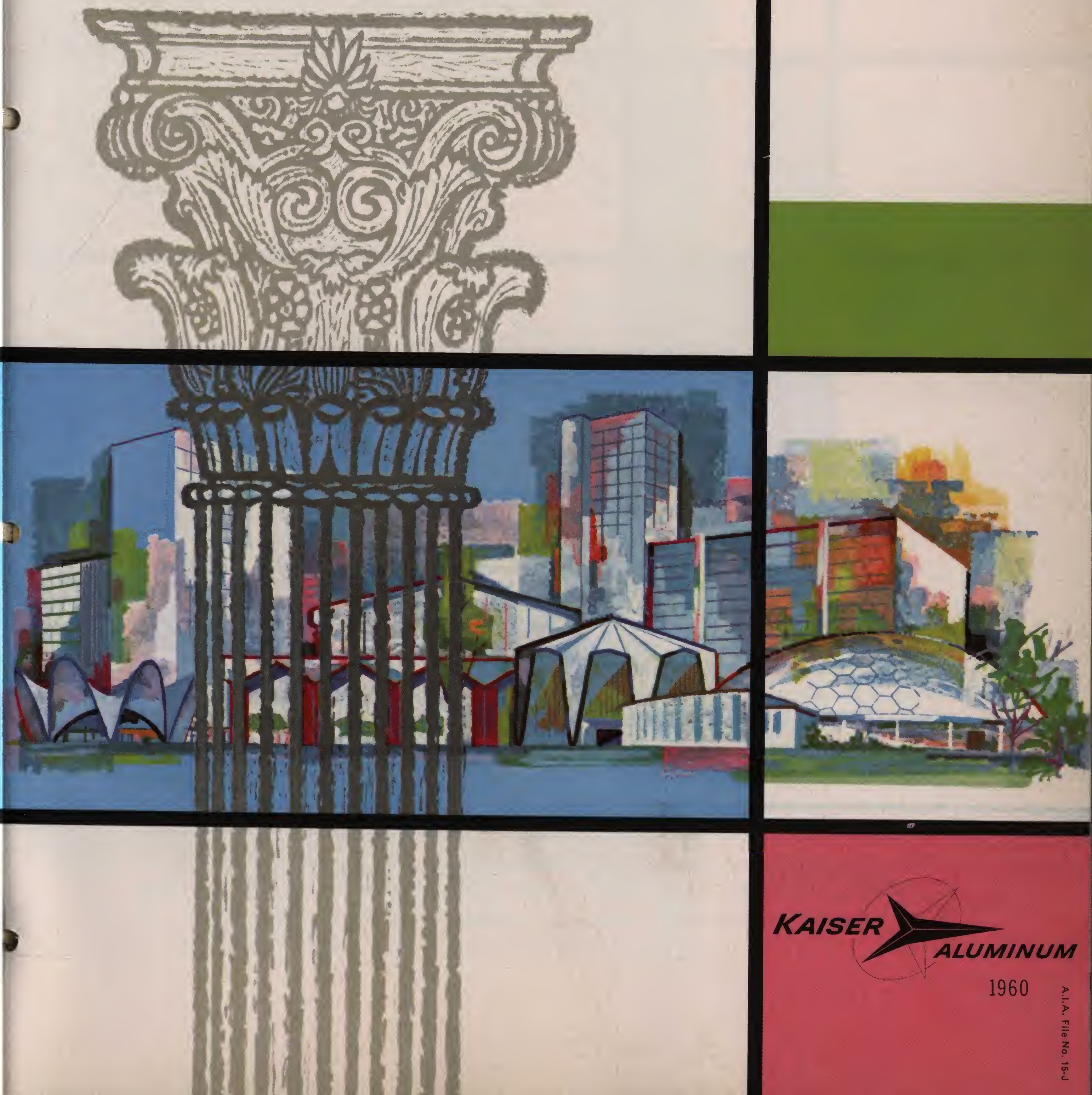
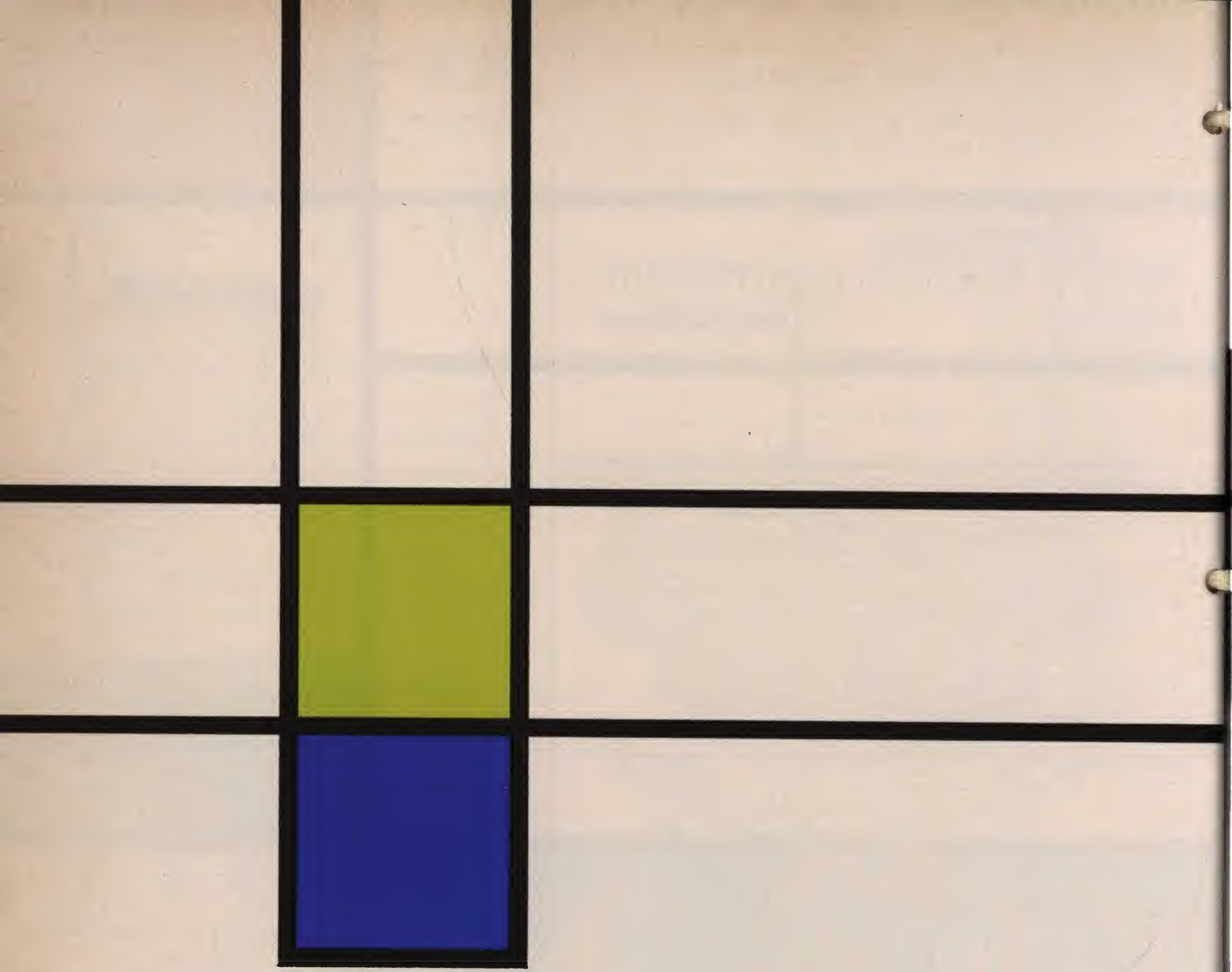
Aluminum in Architecture



KAISER ALUMINUM

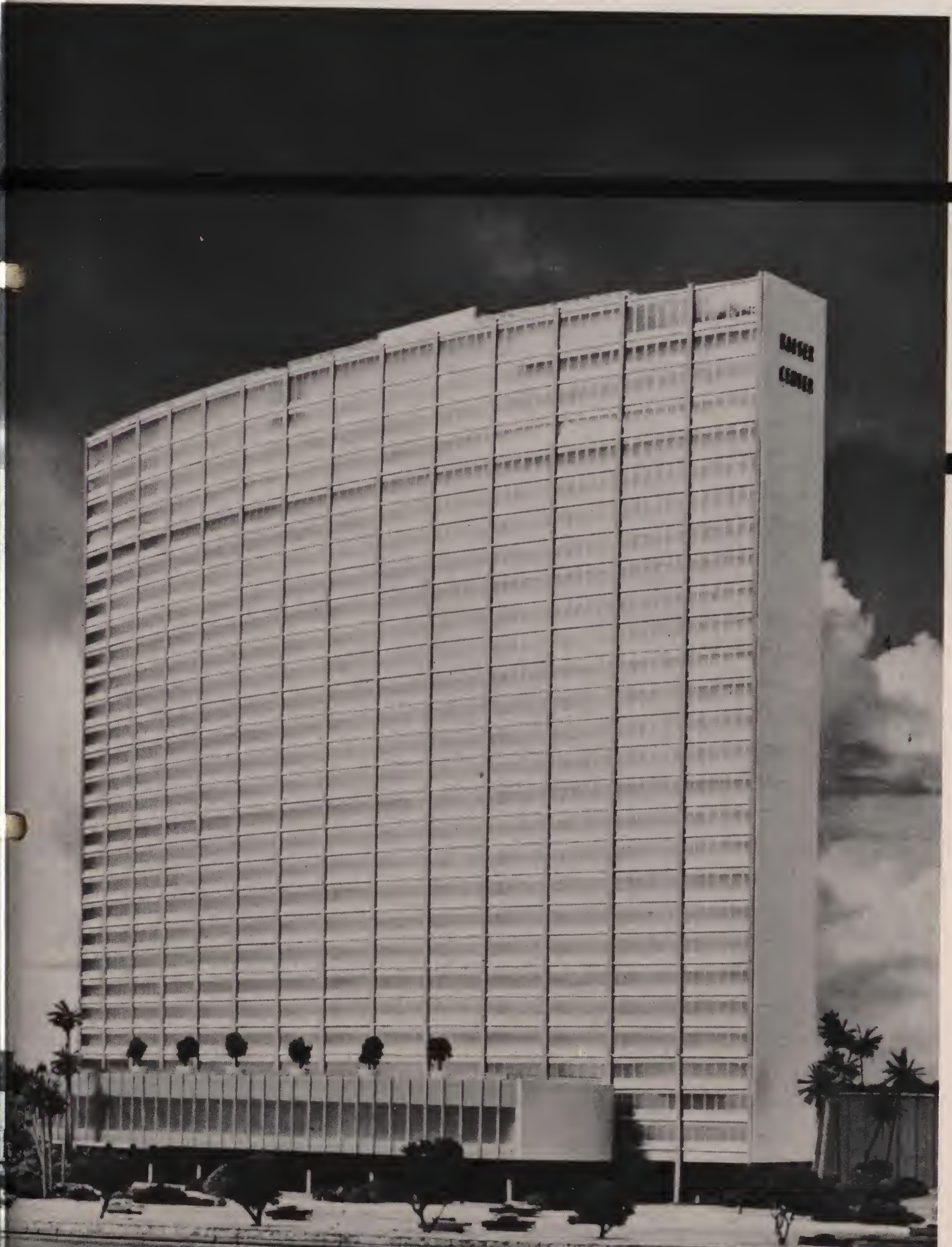
1960

A.I.A. File No. 15-J



WHAT THE ARCHITECT CONCEIVES . . . ALUMINUM ACHIEVES!

Aluminum is one of the most versatile of all building materials. It is inherently attractive, strong, and durable. It has a long record of successful performance under exacting conditions in many architectural applications. It is easily worked and can be formed by a variety of production and fabricating methods to meet the requirements of almost any design. It can be given texture, color, or varying degrees of luster to accentuate form or enhance its natural beauty. Few materials readily available today offer comparable reliability and freedom for creative expression. Kaiser Aluminum architectural representatives are working closely with architects and fabricators throughout the country to help apply the advantages of aluminum to architecture. This service is immediately available without obligation to any architect who is interested in the virtually unlimited design opportunities that aluminum offers.



Kaiser Center, Oakland, California
Architects: Welton Becket, F.A.I.A., & Associates
General contractor: Robert E. McKee, Inc.
Aluminum subcontractor: Kawneer Co.
Aluminum Components:
- Mullions—No. 10 architectural extrusions (natural).
- Spandrel panels—No. 80 architectural sheet (gold).
- Beam covers—No. 10 architectural sheet (natural).
- Column covers—No. 30 architectural sheet and extrusions (dark gray).

KAISER ALUMINUM

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▲ The tables on pages 8 and 9 can be used as a guide to selection of alloys for given applications. The alloys listed are those most widely used for architectural applications and are available as "mill standard."

■ The tables on pages 10 and 11 provide technical information and properties of the various architectural alloys available. These tables will be of help where structural stresses must be taken into consideration.

● Technical information on architectural finishes for aluminum is included on pages 17, 18, 19. This material is included as a guide in specifying finish treatments.

USE OF THIS CATALOG . . .

The purpose of this catalog is to help the architect specify aluminum most effectively in his designs.

Alloys—It is important to recognize that there are many types of aluminum alloys, each with specific properties and characteristics. Therefore a guide is provided here to help assure proper alloy selection for given applications. Alloys commonly used architecturally are described so that consideration may be given to the factors that determine proper alloy selection, such as formability, strength, weldability, finishability.

Standard aluminum products are offered in certain alloys because they have been determined generally the most satisfactory for the applications for which they are intended. However, this does not preclude the architect's specifying other alloys to meet special requirements.

Type or form of product to be used—Architectural aluminum is available in a variety of forms. Most products are fabricated of sheet, plate, extrusions, forgings or castings, or a combination of these forms. Data is provided here so that comparisons may be made of one form versus another (formed sheet sections, for example, versus extruded sections).

Color, texture, other finishes—Because appearance is a basic consideration in architectural design, and since there are many excellent finishing treatments for aluminum from which selections may be made, information is included here to help make the proper selection. Information is given on anodic finishes that produce (1) natural-color oxide films, (2) integral-color (gold and grays) oxide films that are lightfast, and (3) dyed-color oxide films. Other finishes that may be specified to produce color—porcelain enamel, paints, lacquers—are discussed, as are chemical conversion coatings (prepaint treatments). Textures may be produced by embossing rolls, chemical etch treatments or by a variety of mechanical means. These, too, are described.

Sizes—Limitations on sizes of aluminum products are imposed by limitations of equipment available to produce basic aluminum forms and to fabricate and process specific products. Selection tables are included here essentially to indicate these limitations and to list standard product availabilities.

Where special problems in specifying arise, or where special size requirements may be necessary, consultation with your Kaiser Aluminum architectural representative is recommended.

Edgemont Clinic, Los Angeles. Architect: Clarence W. Mayhew. General contractor: M. J. Brock & Sons. Aluminum subcontractor: Ador Corporation, Aluminum components: spandrel panels—No. 80 architectural sheet (gold); mullions—6063 extrusions.

WHAT IS ALUMINUM?

Versatile aluminum is the lightest weight, lowest cost, commercially available metal. High-purity aluminum is soft and ductile; strength and hardness are acquired with the addition of alloying elements such as copper, manganese, magnesium, silicon and zinc. Certain alloys are particularly suited for architectural applications. Characteristics and properties of the alloys commonly used architecturally are included on pages 8 to 11.

Aluminum products are either "wrought" or "cast," depending on whether their shape results from mechanically working the metal or from casting molten metal. Special alloys have been developed for each method of manufacture. Wrought alloys are used to produce sheet products, extruded shapes and forgings. Casting alloys are used for the production of ornamental components and the mass production of standard parts.

WHY ALUMINUM?

Many qualities combine to make aluminum an outstanding building material. Here, briefly, are some of its more important advantages in architectural use.

Light Weight—Aluminum is approximately three times lighter than commonly used metals such as steel, copper and brass. One cubic inch weighs approximately one-tenth of a pound.

Strength—Alloys and tempers of aluminum are available to meet almost any strength requirement. Some aluminum alloys exceed the strength of low-carbon steel.

Durability—Aluminum has a high inherent resistance to atmospheric corrosion. An oxide film forms naturally on aluminum surfaces exposed to air, protecting the metal against corrosive attack. This film can be artificially produced and the protection increased by an electrolytic treatment—anodizing.

Minimum Maintenance—Properly installed, aluminum provides years of dependable service with minimum maintenance. Its permanent finishes eliminate costly maintenance painting. Used in wall construction, large aluminum panels reduce the numbers of joints, provide greater weathertightness, and reduce wall deterioration.

Economy—Aluminum sheet gives three times greater area coverage per unit of weight than other commonly used metals of equal thickness. The excellent strength-weight ratio of aluminum eliminates useless weight, reduces dead load, permits lighter structural framing and smaller foundations. It also minimizes freight, handling and installation costs—and permits faster erection and completion.

Federal Reserve Bank, Chicago, Ill.
Architects: Naess & Murphy.
General contractor: George A. Fuller.
Aluminum subcontractor: Flour City Ornamental Iron Co.
Aluminum components: windows, mullions, spandrels—
No. 30 architectural extrusions (gray)

Appearance—The natural appearance of aluminum and variety of surface finishes which may be applied make this metal especially attractive for architectural applications. In addition, unlike many other metals, aluminum does not cause unsightly weathering stains.

Workability—Aluminum sheet responds readily to bending, stamping, roll forming, drawing, embossing, cutting, and spinning operations. It may be extruded, cast and forged. It can be joined by all commonly used methods—welding, adhesives, mechanical fasteners.

Reflectivity—The natural surface of aluminum has high reflectivity to both light and radiant energy (heat). This property, together with very low emissivity, is of outstanding value in applications where thermal insulation and interior heat gain are important.

Thermal Conductivity—On a weight basis, aluminum is the most efficient heat conductor of the common metals, of marked advantage when it is desirable to conduct or dissipate heat rapidly and uniformly.

Electrical Conductivity—Aluminum has the highest electrical conductivity of all known metals, based on weight, and is the leading metal used for transmission lines (initial use 1898). This factor, combined with light weight and low cost, makes aluminum the most economical electrical conductor.

Non-sparking—Aluminum is non-sparking, an important quality when explosion hazards exist.

Non-magnetic—Aluminum is non-magnetic, a property of frequent advantage in the electrical and electronics industries.

DESIGN CONSIDERATIONS AND LIMITATIONS OF USE

Aluminum has certain properties that require the architect's attention in using it most effectively.

Selection of Alloys—The selection of an alloy for a particular application should be based on a careful evaluation of design requirements and the metal's mechanical properties and finishing characteristics. More than one alloy and temper may be used successfully for the same type of application, and different alloys may be used in various parts of an assembly to take advantage of specific properties. If both sheet and extrusions are used together and are to be anodized, appearance match is desirable. (Refer to the anodized aluminum alloy appearance-match table on page 17.)

Standard alloys available for architectural applications are listed in the selection tables on pages 8-11.

Surface Protection—Although aluminum may not always require surface protection, a standard surface treatment is recommended for exterior applications whenever appearance is a factor. The electrolytic process known as anodizing develops a thicker and stronger oxide film than that naturally formed on the surface of aluminum, and thus increases resistance to corrosive attack. Unlike most other protective coatings, particularly those for other metals, this film does not require periodic renewal. Surface protection should be specified where necessary: Maintained surfaces with exterior exposure should be anodized to produce a minimum oxide film thickness of 0.0004″. Unmaintained surfaces, or those subjected to harsh urban environment, should be anodized to produce a minimum film thickness of 0.0008″. Such protective treatment will prolong the life, and particularly the appearance life, of aluminum components, with only a minimum of maintenance being required.

For protection during construction, a coat of water-white methacrylate lacquer should be specified to follow fabrication and/or anodizing. (For additional information on finishes, see pages 17, 18 and 19.)

Corrosive Environments—Aluminum is naturally immune to attack by many acids and corrosive atmospheres. The wide and successful use of aluminum in containers for many acids, solvents, foods and other products, is evidence that many chemicals have no harmful action. Alkalis and a few strong acids (particularly chlorides and fluorides), however, penetrate the oxide coating and rapidly attack aluminum. Such environments should be avoided.

Contact with Dissimilar Materials—Contact between aluminum and dissimilar metals or absorptive materials in the presence of moisture can cause corrosion of the aluminum. Drainage of surface water from components of dissimilar metals onto aluminum surfaces should be avoided. (See "Protection of Contact Surfaces," page 23, for recommendations.)

Expansion and Contraction—Aluminum has a comparatively high coefficient of expansion (0.000013/degree F/unit of length). In building design, provision should be made for expansion and contraction caused by temperature changes. This is especially important where aluminum meets other materials with different coefficients of expansion.

Welded Joints—Practically all aluminum alloys can be welded. For fusion welding, the inert-gas shielded-arc methods are now used almost exclusively. They offer the advantages of high welding speed and freedom from flux problems. The three methods of resistance welding—spot, seam and flash butt—are also readily adaptable to joining aluminum. Alloy 4043 is considered an excellent choice for welding wire where high-strength welds are required. If an assembly is to be anodized, however, use of 4043 should be limited to concealed joints. In the anodized condition this alloy becomes dark gray, and there may be some discoloration in the heat-affected areas around the weld.

Where joints cannot be inconspicuously located, and appearance of the weld in the anodized condition is important, welding wire of alloys such as 1100, 5154 and 5356 may be used. As a rule, welding wire of an alloy similar in composition to the alloy used in the assembly to be welded results in best appearance-match after anodizing.

Color Anodizing—Anodic oxide films that derive color from the aluminum alloys themselves (architectural alloys No. 20, 30, 40 and 80) are lightfast—hence, most satisfactory for architectural use. Color can also be introduced by dyes. While this is a means of providing color, many coloring agents presently available are subject to noticeable fading under prolonged exposure to sunlight. (See page 17 for anodized-appearance-match information.)

Maintenance Cleaning—Although the original appearance of aluminum will not remain indefinitely without further treatment, the light gray oxide which builds up gradually is not objectionable. Like all exterior surfaces, however, aluminum will accumulate airborne dust and grime, and surface attack is fostered by the continual presence of a layer of dirt. Therefore, exterior aluminum surfaces should be cleaned periodically to preserve their appearance.

Greyhound Bus Terminal, Detroit. Architects: Arrasmith & Tyler; Clair Ditchy, F.A.I.A. Aluminum subcontractor: Construction Specialties, Inc. Aluminum components: sun-control louvers, railings.

ALLOY SELECTION GUIDE

TYPICAL USE	RECOMMENDED ALLOY	COMMENTS
Anodized Sheet Formed Sheet Sheet Metal Plate Trim, Column Covers, Spandrel Panels, Sun Control Devices, Industrial Roofing and Siding, Facings, Ductwork, Gutters, Flashing.	**No. 10, 10A Architectural Sheet**	Clad sheet products having superior anodizing and finishing characteristics. Essentially same mechanical properties as 5005 and 1100 alloys.
	No. 20, 30 and 40 Architectural Sheet	Clad sheet products having special finishing characteristics. Turn to shades of gray when anodized, the shade darkening as the anodizing time increases. No. 40 architectural sheet produces the darkest shades. Good color fastness characteristics and corrosion resistance. Essentially same mechanical properties as 3003 alloy.
	No. 80 Architectural Sheet	A special clad sheet product that becomes gold-colored when anodized. Color is inherent in the alloy; no dyes or other coloring agents are used. Color is uniform, sunfast. Available in embossed patterns only. Essentially same mechanical properties as 3003 alloy.
	1100	Low-strength sheet, accepts high degree of forming. When highest quality finishing characteristics are required specify No. 10A architectural sheet.
	3003	Economical general purpose sheet alloy having excellent formability and good corrosion resistance. Assumes a slight yellowish cast upon anodizing.
	alclad 3004	Best corrosion resistance and strength characteristics of roofing and siding sheet. Available in corrugated, ribbed or V-beam sections and various embossed patterns.
	5005	An economical all-purpose sheet having good corrosion resistance, formability and finishing characteristics. Best-quality sheet for general-purpose work. When anodized, closely matches anodized 6063 extrusions in appearance, and is clearer and brighter than either 3003 or 5052 alloys. When highest quality finishing characteristics are required, specify No. 10 architectural sheet.
	5050	A good finishing alloy having a comparatively clear white appearance after etching and anodizing. Excellent weldability and resistance to corrosion. Stronger than 3003 or 5005 alloys but not as strong as 5052.
	5052	Strongest common alloy in general use. Good formability and excellent resistance to corrosion particularly in seacoast environment. Good weldability but may require careful techniques. Assumes yellowish cast when anodized. With thin anodic coating has fair appearance match with anodized 6061 and 6063 alloy extrusions.
	6061	Principally used for roll-formed structural shapes or extremely high strength sheet applications. Good resistance to corrosion. Very good appearance match with 6061 extrusions but is cloudy in comparison with most other alloys. Sheet is sometimes clad for superior appearance and/or additional corrosion resistance.
	Kaiser Aluminum Duct Sheet	Low-cost sheet for duct systems.
Fasteners Rivets, Nails, Screws, Bolts, etc.	**1100**	For low-strength rivets and washers. Plain or anodized.
	6061	For high-strength rivets. Plain or anodized.
	2024	Bolts, nuts, screws and nails. Plain or anodized.
	5056	Nails and rivets. Plain or anodized.

TYPICAL USE	RECOMMENDED ALLOY	COMMENTS
Extruded Shapes Copings, Gravel Stops, Fascia, Thresholds, Glazing Members, Handrails, Trim, etc.	6063	Most commonly used extrusion alloy. Good strength. Good appearance match for anodized 5005 sheet.
	6061	Principally used for extruded structural shapes or other applications requiring high strength. When anodized has good appearance match with anodized 6061 alloy sheet but appears cloudy in contrast to most other alloys.
	No. 10 Architectural Extrusions	For ornamental components. High surface quality; free from streaking. Natural aluminum color when anodized. Matches No. 10 and 10A architectural sheet.
	No. 20, 30 Architectural Extrusions	For ornamental components. Turn to shades of gray when anodized, matching No. 20 and 30 architectural sheet, 43 and 356 castings.
Screening And Gratings	alclad 5056	Aluminum wire which is usually drawn and woven into insect screening or wire cloth. Available in wide range of opening dimensions.
	5052	In heavier gauges, used for expanded gratings and walkways. Also used for light-gauge shelving, protective screening and ornamental grillwork. Used for Kaiser Aluminum ShadeScreen, a sun and insect protection device used in the same manner as ordinary wire cloth.
Porcelain Enameled Aluminum	1100 3003 6061	Sheet and plate — A broad range of colors may be had in matte, semi-gloss or gloss finish.
	6061 6062 6063	Extrusions
	43 356	Castings
Welded Members	3003	Tube and pipe primary welded usage.
	5052	Excellent corrosion resistance, particularly in exposure to salt water. Good weldability but may require careful techniques.
	5083	Structural applications requiring good corrosion resistance and maximum weld strength. Available as plate or extrusions.
	5086	For those structural applications requiring good corrosion resistance as well as high strength after welding. Available in sheet, plate and extrusions.
	6061	Least expensive, most versatile heat-treatable alloy, and the only one that is readily fusion welded. Good resistance to corrosion. Sheet sometimes clad for superior appearance and/or additional corrosion protection.
Castings Ornamental Work and Hardware	43	Hardware, treillage, cast spandrel covers and other ornamental work where low strength is acceptable. Turns gray color upon anodizing to match No. 20 architectural sheet.
	214	Best appearance match with anodized 6063 extrusions. Better strength than 43 alloy castings.
	356	High strength casting alloy. Turns gray when anodized to match No. 30 architectural sheet.

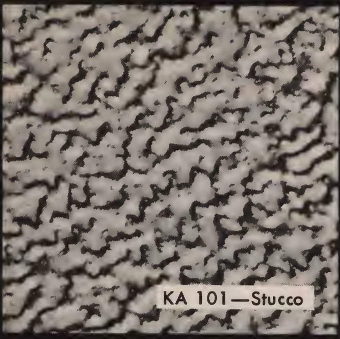
TYPICAL PROPERTIES OF ARCHITECTURAL ALUMINUM ALLOYS

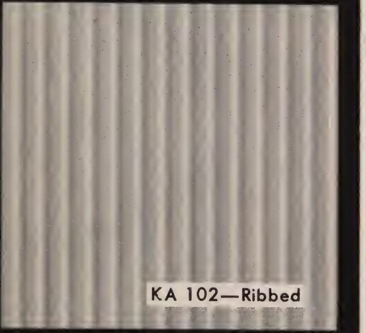
NON-HEAT-TREATABLE ALLOYS

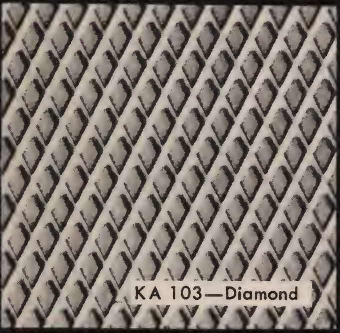
ALLOY	TEMPER	TENSILE PROPERTIES		SHEAR	ELASTIC MODULUS PSI	MAJOR ALLOYING ELEMENTS						FEDERAL OR MILITARY SPECIFICATION	ASTM SPECIFICATION
		Yield Strength PSI	Ultimate Strength PSI	Shearing Strength PSI		SI. %	CU. %	MG. %	MN. %	CR. %	Weight Lbs./ Cu. In.		
1100 (sheet, plate)	0	5,000	13,000	9,000	10,000,000	99% ALUMINUM (MINIMUM)					0.098	QQ-A-561 (sheet, plate) MIL-W-7986 (rivets)	B209 (sheet, plate) B316 (rivets)
	H12	15,000	16,000	10,000									
	H14	17,000	18,000	11,000									
	H16	20,000	21,000	12,000									
	H18	22,000	24,000	13,000									
3003 (sheet, plate)	0	6,000	16,000	11,000	10,000,000				1.2		0.099	QQ-A-359 (sheet, plate) WW-T-788 (tube, pipe)	B209 (sheet, plate) B235 (tube) B241 (pipe)
	H12	18,000	19,000	12,000									
	H14	21,000	22,000	14,000									
	H16	25,000	26,000	15,000									
	H18	27,000	29,000	16,000									
alclad 3004 (sheet, plate)	0	10,000	26,000	16,000	10,000,000			1.0	1.2		0.098	none	B209 (sheet, plate)
	H32	25,000	31,000	17,000									
	H34	29,000	35,000	18,000									
	H36	33,000	38,000	20,000									
	H38	36,000	41,000	21,000									
5005 (sheet, plate)	0	6,000	18,000	11,000	10,000,000			0.8			0.098	none	B209 (sheet, plate)
	H12	19,000	20,000	14,000									
	H14	22,000	23,000	14,000									
	H16	25,000	26,000	15,000									
	H18	28,000	29,000	16,000									
	H32	17,000	20,000	14,000									
	H34	20,000	23,000	14,000									
	H36	24,000	26,000	15,000									
	H38	27,000	29,000	16,000									
5050 (sheet, plate)	0	8,000	21,000	15,000	10,000,000			1.4			0.097	none	B209 (sheet, plate)
	H32	21,000	25,000	17,000									
	H34	24,000	28,000	18,000									
	H36	26,000	30,000	19,000									
	H38	29,000	32,000	20,000									
5052 (sheet, plate)	0	13,000	28,000	18,000	10,200,000			2.5		0.25	0.096	QQ-A-318 (sheet, plate)	B209 (sheet, plate)
	H32	28,000	35,000	20,000									
	H34	31,000	38,000	21,000									
	H36	35,000	40,000	23,000									
	H38	37,000	42,000	24,000									
5056 (rod, wire)	0	22,000	42,000	26,000	10,300,000			5.0			0.095	MIL-W-7986 (nails, rivets)	B316 (nails, rivets)
	H18	59,000	63,000	34,000									
	H36	50,000	60,000	32,000									
5083 (plate, extrusions)	0	0.25" to 0.75" 22,000	44,000		10,300,000			4.4	0.7		0.096	MIL-A-17358 (sheet, plate) MIL-A-19005 (extrusions)	B209 (sheet, plate)
		0.751" to 2" 20,000	41,000										
	H113	0.25" to 2" 33,000	46,000										
5086 (sheet only)	0	17,000	38,000	23,000	10,300,000			4.0	0.4		0.096	MIL-A-19070 (sheet, plate)	B209 (sheet, plate)
	H32	30,000	42,000										
	H34	37,000	47,000	27,000									
	H112	19,000	39,000										

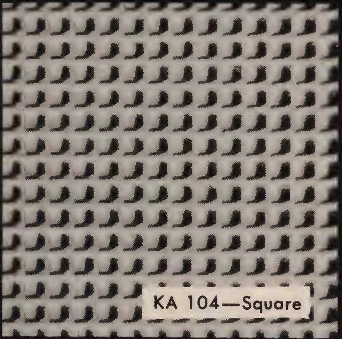
HEAT-TREATABLE ALLOYS

ALLOY	TEMPER	TENSILE PROPERTIES		SHEAR	ELASTIC MODULUS PSI	MAJOR ALLOYING ELEMENTS						FEDERAL OR MILITARY SPECIFICATION	ASTM SPECIFICATION
		Yield Strength PSI	Ultimate Strength PSI	Shearing Strength PSI		SI. %	CU. %	MG. %	MN. %	CR. %	Weight Lbs./ Cu. In.		
6061 (sheet, plate, extrusions)	0 T4 T6	8,000 21,000 40,000	18,000 35,000 45,000	12,000 24,000 30,000	10,000,000	0.6	0.25	1.0		0.25	0.098	QQ-A-327 (sheet, plate) QQ-A-270 (extrusions) MIL-R-1150 (rivets)	B209 (sheet, plate) B211 (rod and bar) B221 (extrusions) B308 (extrusions) B316 (rivets)
6062 (extrusions)	0 T4 T6	8,000 21,000 40,000	18,000 35,000 45,000	12,000 24,000 30,000	10,000,000	0.6		1.0			0.098	QQ-A-270 (extrusions)	B221 (extrusions) B308 (structural shapes)
6063 (extrusions, rod bar, pipe, tube)	0 T42 T5 T6	7,000 13,000 21,000 31,000	13,000 22,000 27,000 35,000	10,000 14,000 17,000 22,000	10,000,000	0.4		0.7			0.098	QQ-A-274 (extrusions)	B221 (extrusions)
2024 (rod, wire)	0 T36 T4	11,000 57,000 47,000	27,000 72,000 68,000	18,000 42,000 41,000	10,600,000		4.2	1.5			0.101	QQ-A-268 (bolts, nuts, nails)	B211 (bolts, nuts, nails)
CASTING ALLOYS													
43	SAND CAST PERMANENT MOLD DIE CAST	8,000 9,000 16,000	19,000 23,000 30,000	14,000 16,000 19,000	10,300,000	5.0					0.097	QQ-A-601 (sand) QQ-A-596 (permanent mold) QQ-A-591 (die) MIL-A-15153 (die)	B26 (sand) B108 (permanent mold)
214	SAND CAST PERMANENT MOLD	12,000 16,000	25,000 27,000	20,000 22,000				3.8			0.096	QQ-A-601 (sand)	B26 (sand) B108 (permanent mold)
356	SAND CAST T6 PERMANENT MOLD	24,000 27,000	33,000 40,000	26,000 32,000	10,500,000	7.0		0.3			0.097	QQ-A-601 (sand) QQ-A-596 (permanent mold)	B26 (sand) B108 (permanent mold)


KA 101—Stucco


KA 102—Ribbed

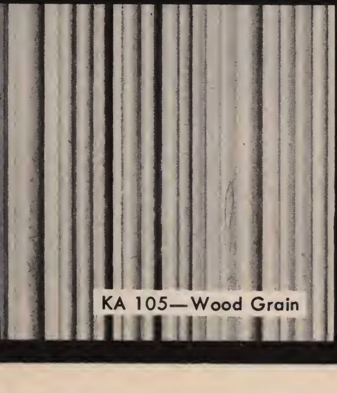

KA 103—Diamond

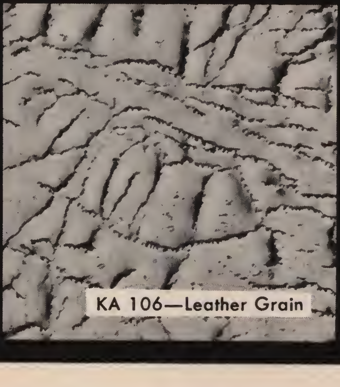

KA 104—Square

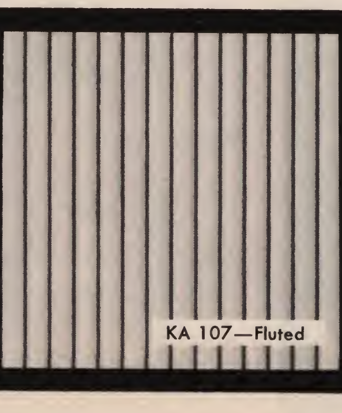
Northern Natural Gas Company, Omaha. Architects: John Latenser & Sons. General contractor: Peter Kiewit Sons Co. Aluminum subcontractor: Flour City Ornamental Iron Co. Aluminum components: spandrel panels—No. 20 architectural sheet (gray) mullions—6063 extrusions.

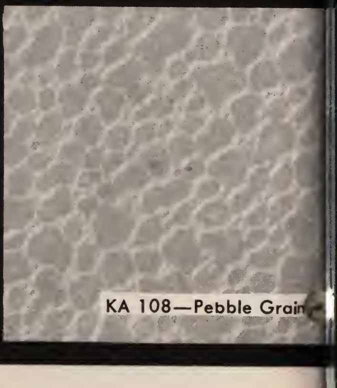
SHEET PRODUCTS

Kaiser Aluminum standard sheet products are produced in a variety of alloys and tempers to meet a wide range of requirements. (Industry standards define as sheet rolled metal from 0.006″ to 0.250″ in thickness.) Flat sheet is available up to 80″ in width, in standard lengths up to 288″. Consult your Kaiser Aluminum architectural representative for more detailed information on standard sheet products.


KA 105—Wood Grain


KA 106—Leather Grain


KA 107—Fluted


KA 108—Pebble Grain

SPECIALTY SHEET PRODUCTS

ARCHITECTURAL SHEET

Some aluminum sheet products for architectural applications are produced as "clad" products. They are actually composite materials produced by placing relatively thin slabs of special alloy on each side of an ingot and pressure welding the "sandwich" together by a hot rolling operation.

Clad products are produced for their superior finishing qualities or appearance after anodizing (freedom from structural streaking) or, in the case of high-purity alloy cladding, to increase corrosion resistance.

Mechanical finishes for clad sheet products must be very light in order to avoid cutting through the cladding and exposing the core metal, which usually is of inferior anodizing quality.

No. 10 and 10A Architectural Sheets—These are specialty sheets clad on both sides and especially suited for natural aluminum-color anodized finishes. A chemical etch or light mechanical preparation of the surface performed prior to anodizing assures a surface of uniform quality and appearance, substantially free from structural streaks. These sheets have high corrosion resistance, good formability characteristics, and are well suited for interior and exterior architectural applications.

No. 20, 30 and 40 Architectural Sheets—These specialty sheet products are clad on both sides and develop a uniform gray-colored finish of high quality when given standard anodizing (a dye is not introduced in the anodizing process). The color is virtually lightfast under prolonged exposure to sunlight.

The primary distinction between the three types of sheet is the range of gray shades obtainable, from light gray in No. 20 to dark gray in No. 40. All have high corrosion resistance, good formability characteristics, and are especially intended for exterior and interior architectural applications.

No. 80 Architectural Sheet—This sheet is clad with an alloy that produces a uniform gold color when anodized by standard methods. No dyes or other coloring agents are used. No. 80 anodized architectural sheets have the same corrosion resistance, strength and formability characteristics as the natural and gray-colored sheets, are practical for either interior or exterior use. The anodized color produced is sunfast, unaffected by weathering. These sheets are available embossed only, in all standard embossed patterns.

SELECTION DATA—ARCHITECTURAL SHEET

SHEET	PROPERTIES (similar to)	TEMPER	THICKNESS (in.)		MAXIMUM SIZE (in.)	
			MIN.	MAX.	WIDTH†	LENGTH*
No. 10	5005	0, H12, H14, H16, H18	0.019	0.250	60	180
No. 10A	1100					
No. 20	3003	0, H111, H12, H14, H16, H18	0.051	0.250	72	288
No. 30	3003					
No. 40	3003					
No. 80	3003	H114, H134, H154, H174	0.060	0.125	60	288

†depending on temper and embossed pattern availability
*depending on thickness

EMBOSSED SHEET

Embossed sheet products have a pattern impressed on one or both sides. Single-side embossing leaves the opposite side smooth. The two sides of the sheet differ slightly in appearance and design effect where both sides are embossed. Embossed sheet offers increased stiffness over standard flat sheet and provides a mar-resistant finish which diffuses incident light.

Standard depth of embossing impression is 0.010″; for light embossing the impression depth is 0.005″. Embossed sheet is available in thicknesses 0.010″ to 0.064″, widths up to 60″, lengths as required.

Double embossing can be specified to meet specular reflection requirements, such as for military air-field construction. The process superimposes one embossed pattern over another, creating a surface that provides a maximum of light diffusion.

Kaiser Aluminum embossed sheets are used for doors, partitions, spandrel panels, column covers, and other decorative applications. They are available in alloys 1100, 3003, 5050, 5052 and in No. 10, 10A, 20, 30, 40 and 80 architectural sheets. Typical patterns are shown here (actual size) with appropriate specification numbers.

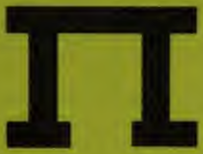
SATIN-TEX SHEET

A satin-finished surface called Satin-Tex is available for Kaiser Aluminum sheet. This is a controlled belt-sanding operation that produces variations in texture according to the grit size used. The sheet is supplied in all common alloys. The uniform and pleasing appearance of Satin-Tex sheet is particularly suited to decorative applications.

Satin-Tex sheet is available up to 48″ wide, 144″ long. Thicknesses are from a minimum of 0.019″ to a maximum of 0.250″. Standard texture gradations are coarse, medium and fine.

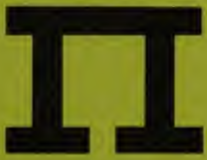
TREAD PLATE

Kaiser Aluminum tread plate is a skid-resistant floor surface covering. It has a raised diamond embossed surface. It is available in alloys 6061, 5083 and 5086. Widths vary from 24″ to 60″, lengths from 72″ to 240″. Thicknesses are from a minimum of 0.100″ to a maximum of 0.500″.



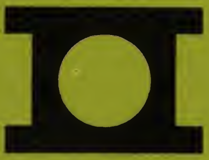
SOLID EXTRUDED SHAPE

Any extruded shape other than a hollow or semi-hollow extruded shape.



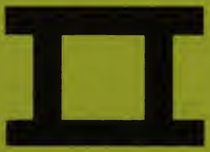
SEMI-HOLLOW EXTRUDED SHAPE

An extruded shape, any part of whose cross section partially encloses a void.



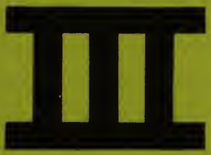
CLASS I HOLLOW EXTRUDED SHAPE

A hollow extruded shape whose void is round and 1″ or more in diameter, and whose weight is equally distributed on opposite sides of two or more equally spaced axes.



CLASS II HOLLOW EXTRUDED SHAPE

Any hollow extruded shape other than Class I, having a single void and not exceeding a 5 inch circumscribing circle diameter in size.



CLASS III HOLLOW EXTRUDED SHAPE

Any hollow extruded shape other than Class I or Class II.

ALUMINUM EXTRUSIONS

The extrusion process is one in which a hydraulically operated ram exerts pressure against a heated aluminum billet to force metal through openings in a precision-made die. The metal flow occurring during extrusion creates a fine-grained wrought product conforming to the configuration and dimensions of the die openings within close tolerances, and possessing uniformly high mechanical properties.

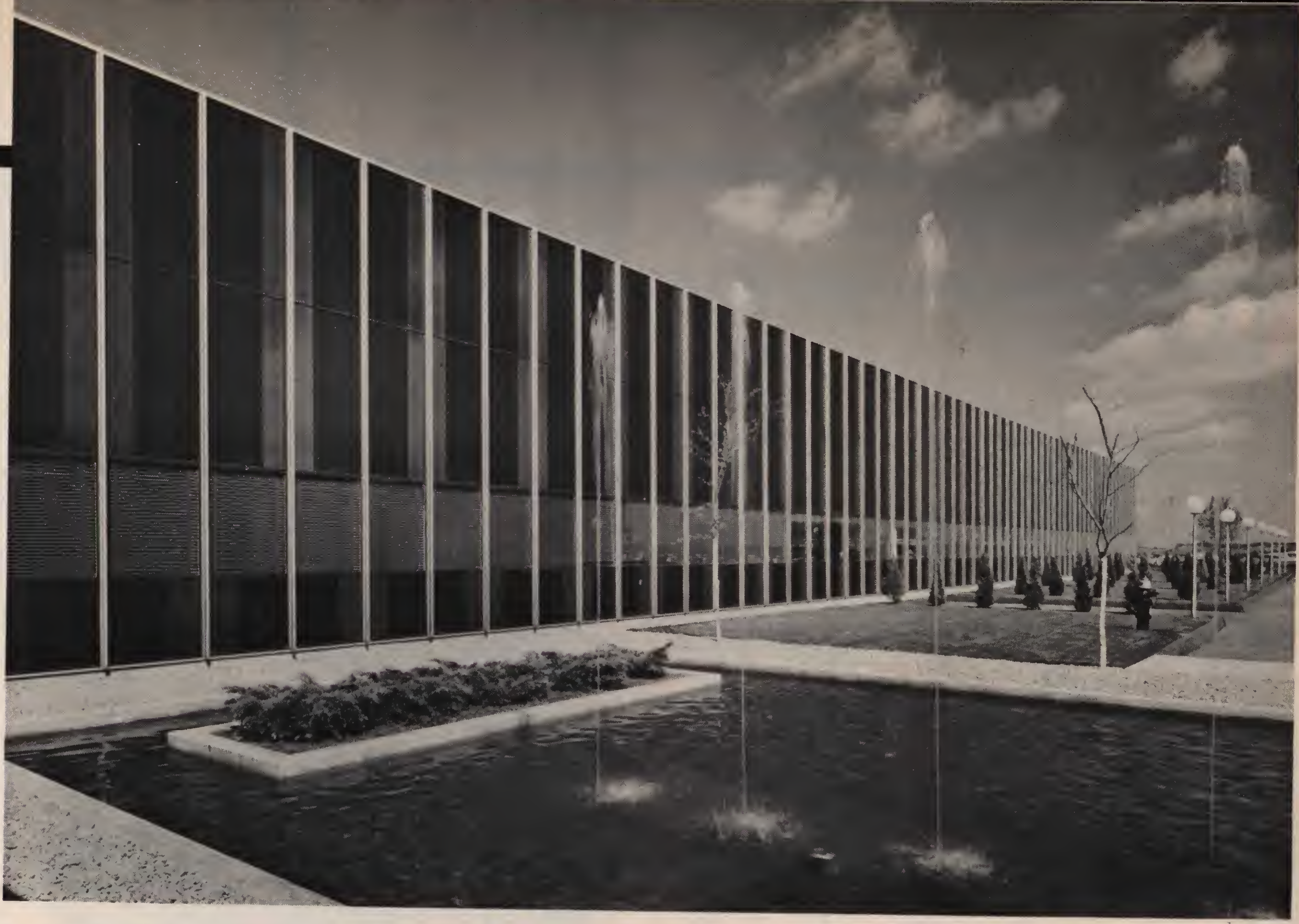
The versatility inherent in the extrusion process and in the design of extrusion dies makes it possible to create and produce an infinite variety of shapes to satisfy exacting functional or aesthetic requirements. A single aluminum extrusion can replace a complex assembly of several roll-formed or brake-formed shapes joined by welding or riveting.

Aluminum extrusions are widely used in architecture, for door and window components; for spandrels, mullions and framing grid members in curtain walls; for structurals; and for a broad assortment of functional and ornamental trim sections. They are available in practical lengths of from 3 to 30 feet, and die costs are relatively low.

Extruded shapes are classified, according to their configurations, as solids, semi-hollows, and three classes of hollows. Hollow shapes are more expensive than solid sections because of the greater difficulty in producing the hollow extrusions. Further, die cost and the minimum allowable wall thickness of an extrusion increase as the over-all cross-section of the extrusion increases. Hence, while complex extrusions up to 24″ wide can be produced, simpler interlocking sections 6″ to 8″ wide will very likely be more economical for most applications.

Kaiser Aluminum markets a complete line of standard architectural extrusions available as stock warehouse items from its distributors. These sections are shown briefly on pages 19 and 20 and in full detail in the Kaiser Aluminum publications, "Copings and Gravel Stops," A.I.A. 15-L, "Thresholds and Window Sills," A.I.A. 14-B, and "Ornamental Extrusions," A.I.A. 15-L.

Consult your Kaiser Aluminum architectural representative for complete information on both standard and custom-designed extrusions and for reliable counsel on the general use of aluminum in architecture.



IBM Manufacturing and Educational Facility, Rochester, Minn. Architects: Eero Saarinen, F.A.I.A., and Associates. General contractor: Johnson, Drake & Piper. Aluminum subcontractor :Flour City Ornamental Iron Co. Aluminum components: Extruded aluminum mullions, porcelain-enamel aluminum spandrel panels.

ALUMINUM CURTAIN WALLS

Interest in the use of curtain walls for buildings has increased greatly over the past decade, the versatility and beauty of aluminum being major factors. The natural appearance of aluminum, the lustrous beauty of its surface and the variety of finishes to which it responds make it a metal especially suited for this use, where appearance is of greatest importance. Curtain walls have been built for many years with traditional materials—today's new materials offer exciting new possibilities in design achievement, construction economy and speed.

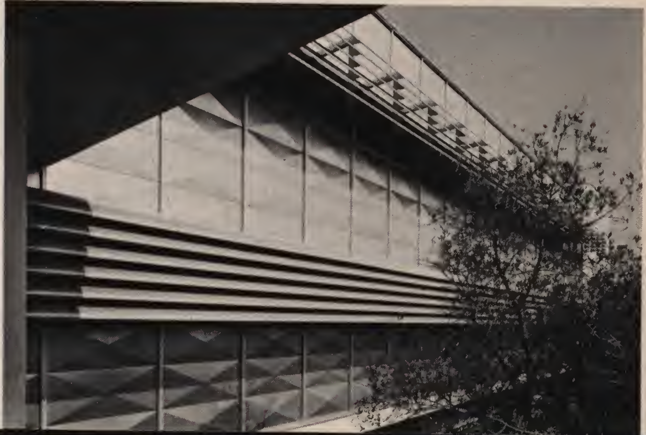
Curtain walls, by definition, are nonload-bearing. The construction has several economic and practical advantages. Because of the lightness of the aluminum curtain wall, the structural framing of the outer walls can be lighter, less costly. These walls are thin, yet highly resistant to the passage of heat; they also provide increased floor space.

Prefabricated units, shop or field assembled, can be delivered to the site ready for erection from inside the building, thereby eliminating the high costs of scaffolding. A further advantage is that buildings can be closed in more readily.

Prefabricated insulated sandwich panels combine the heat-obstructing qualities of standard insulations with the heat-reflective qualities of aluminum to provide a maximum of insulation in a minimum of space.

Light weight simplifies shop handling, reduces shipping costs, simplifies erection. High-strength alloys permit aluminum to meet any strength requirements that might arise.

Aluminum curtain walls offer exceptional value in performance and service life. The high corrosion resistance of the metal reduces maintenance problems to a minimum, assures a long service life for the building exterior.



Edgemont Clinic, Los Angeles. Architect: Clarence W. Mayhew. General contractor: M. J. Brock & Sons. Aluminum subcontractor: Ador Corporation, Aluminum components: spandrel panels No.80 architectural sheet (gold); mullions—6063 extrusions.

There are four general types of curtain wall:

1. The grid system, comprising vertical and horizontal framing of equal emphasis;
2. The mullion type, which emphasizes the vertical supports, with less-conspicuous or no horizontal elements;
3. The spandrel type, which produces a pronounced horizontal-band or horizontal-strip appearance;
4. The sheath type, which minimizes panel direction and structural elements and presents a flat unbroken surface of panel units.

The design of a good curtain-wall system provides for the easy removal of panels or windows in the event of damage.

Where insulated panels are used, they should be designed to satisfy the thermal requirements of the wall, as well as for vapor and sound control.

Provision must be made for washing of windows. Operative windows in the curtain wall will satisfactorily fulfill this requirement. A moving platform which operates on the face of the building can be used for curtain walls with fixed windows.

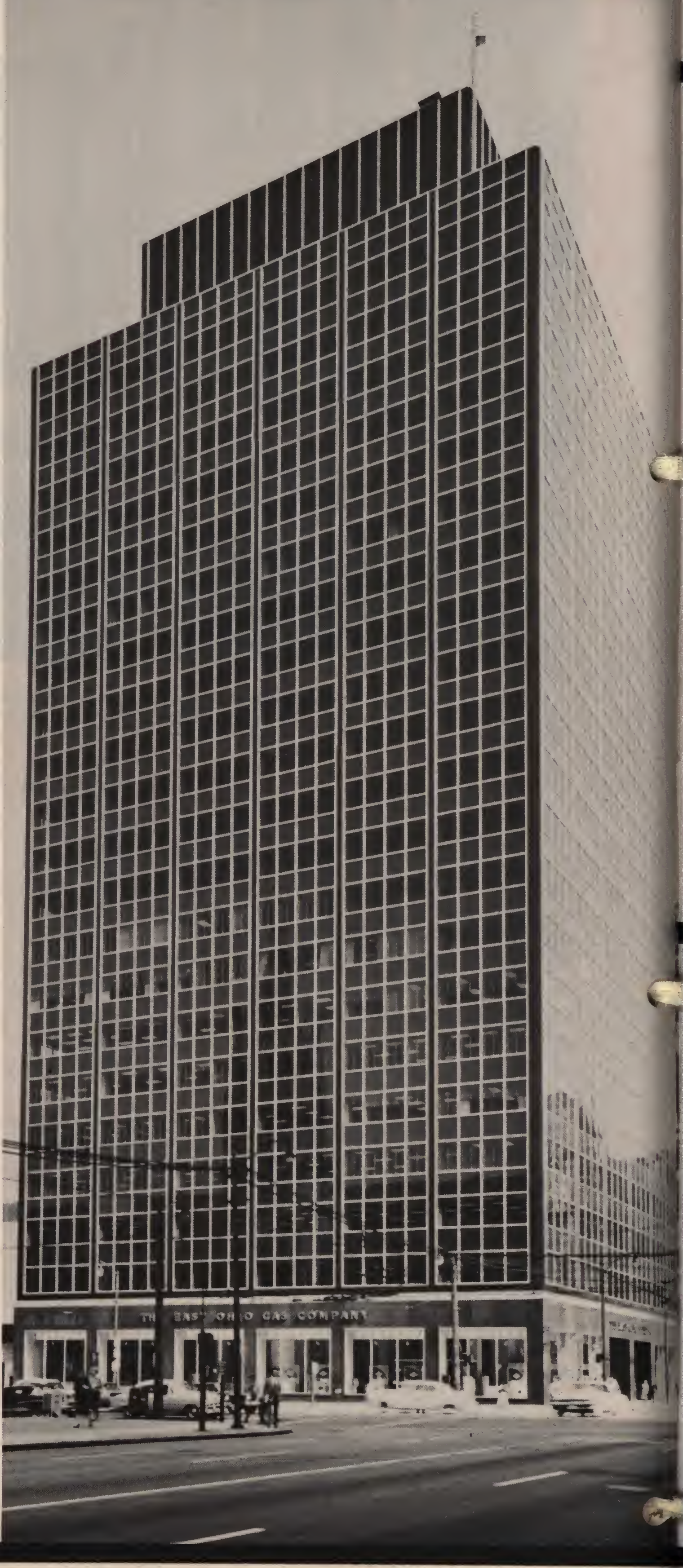
The use of curtain wall should be carefully planned, with allowances made for expansion, contraction and normal construction tolerance. Attachment components should be adjustable where possible, in three directions. Anchor locations should be easily reached, too, well away from slabs or beams. Of primary importance when designing in aluminum is the fact that aluminum components will expand approximately ⅛″ in 10′ in a temperature range of 100°F.

Sound control is also important in curtain-wall design. Noise can be transmitted from room to room or from floor to floor if closures are not carefully made between columns and wall or between floor slab or spandrel beam and wall. A certain amount of vibration noise may be set up if too-thin panels are used. Air movement over weepholes, joints, other small openings and through open-ended hollow mullions are noise factors to be considered.

Three forms of aluminum are used in the construction of curtain walls—sheet, extrusions and castings. The choice of one in preference to another, or their combination, depends mainly upon the size of the building, the architectural effect desired, fabrication considerations, and economy.

All three are available in a number of alloys, making it possible for the architect to select alloys having the proper strength, temper and finishing characteristics required.

Every type of finish compatible to aluminum can be considered practical for use in curtain-wall construction, giving the architect wide freedom in decorative design.



East Ohio Gas Co., Cleveland. Architects: Emery Roth & Sons. General contractor: Tishman Realty & Construction Co. Aluminum subcontractor: Kawneer Co. Aluminum components: No. 20 (gray) architectural-alloy curtain-wall components.

APPEARANCE MATCHING OF ANODIZED ALUMINUM ALLOYS

FINISH LIMITATIONS

This table lists many aluminum alloys in general use in architectural applications, shows approximate appearance matches obtainable through anodizing.

Color anodizing—When colored finishes are specified, exact appearance match should not be expected. Alloy composition tolerances and the many processing variables can affect final color. While color variation may be no greater than that in other building construction materials, greatest satisfaction results when large expanses of color are avoided and colored panels are separated by introduction of another color or by architectural breaks or changes of plane.

Alloys—Architectural sheet and extrusions with corresponding numbers provide best possible anodized appearance match. Otherwise, 5005 alloy sheet and 6063 alloy extrusions provide a generally satisfactory match. 3003 alloy sheet assumes a yellowish cast when anodized, the condition being more noticeable with longer anodizing times. 6061 alloy extrusions in the "as extruded" or mill-finish condition are usually somewhat dingy in appearance. If appearance is important, buffing or other surface finishing should be specified. Anodizing produces an inherent cloudy appearance.

Sheet thickness—Aluminum sheet in heavier thicknesses has a general tendency toward development of structural streaking, which may be visually objectionable in architectural applications. Architectural sheet is substantially free of this tendency and should be specified when best possible finished appearance is desired.

Clad sheet—Mechanical finishes must be light to avoid exposure of core metal, which is usually inferior to cladding in finishing characteristics.

†alclad

*architectural alloys; see page 8 for alloy information

Appearance Match EXCELLENT 🟦

Appearance Match FAIR 🟩

		SHEET AND PLATE											
		10*	10A*	20*	30*	40*	1100	3003	3004†	5005	5050	5052	6061
SHEET AND PLATE	10*	🟦						🟩		🟦	🟩	🟩	🟩
	10A*		🟦										
	20*			🟦									
	30*				🟦								
	40*					🟦							
	1100	🟩					🟦			🟩			
	3003							🟦					
	3004†								🟦				
	5005	🟦					🟩			🟦	🟩	🟩	🟩
	5050	🟩								🟩	🟦	🟩	🟩
	5052	🟩								🟩	🟩	🟦	🟩
	6061	🟩					🟩			🟩	🟩	🟩	🟦
EXTRUSIONS	10*	🟦											
	20*			🟦									
	30*				🟦								
	6061	🟩								🟩	🟩	🟩	🟦
	6062	🟩								🟩	🟩	🟩	🟦
	6063	🟦	🟩				🟩	🟩		🟦	🟩	🟩	🟩
CASTINGS	43			🟦									
	214	🟩								🟩	🟩	🟩	🟩
	356				🟦	🟦							

FINISHES FOR ARCHITECTURAL ALUMINUM

Aluminum can be given texture, color, varying degrees of luster, extra surface hardness, increased resistance to abrasion, added durability through one or a combination of the finishing treatments described below. Your Kaiser Aluminum architectural representative is ready to assist you in developing proper specifications for desired surface finishes.

Interesting effects can be achieved by combining different finishes, different textures, different colors, and by masking certain areas. The architect's own imagination and ingenuity need be the only guide.

MECHANICAL FINISHES

Several mechanical processes can be used to alter the surface appearance of aluminum. A considerable range of textures is possible, depending upon the coarseness of the finishing process selected.

Grinding, belt sanding, polishing, buffing—remove or minimize surface imperfections and abrasions, create lustrous surfaces.

Fine abrasives—such as oil-lubricated abrasive cloths, stainless-steel wool, oil and emery powder, stainless-steel wool lubricated with a neutral soap solution—can be used to produce satin finishes.

Scratch brushing—produces a finish with rotating wire brushes. Coarse brushes create a scratch brush finish; fine brushes create a satin finish.

Sand blasting—quickly and inexpensively produces surfaces that are nonreflective and gray in appearance. Because surfaces are susceptible to handling marks, anodizing is recommended following sand blasting. Sand blasting is used occasionally as prepaint treatment.

The table below can be used as a guide in specifying finish treatments for aluminum. The description of each type of finish provides the architect with a general idea of its appearance and quality. Samples of various finishes are available upon request.

ARCHITECTURAL ALUMINUM FINISHES

TYPE		SPECIFICATION CODE	DESCRIPTION
Natural Finish	As Fabricated	NF	No special finish is applied. Surface is as rolled, extruded, or cast.
Mechanical finishes (See Note 3)	Highly lustrous surface	M-1	Polished (120 to 320 grit). A lustrous finish achieved by preliminary belt polishing with grits coarser than 320, and final polishing with a 320 grit belt used with proper lubrication. The polished surface must be carefully cleaned to maintain its luster.
		M-2	Polished (120 to 320 grit) and buffed. Maximum surface luster, suitable for decorative purposes, is obtained by buffing the M-1 finish with a very fine aluminum buffing compound such as tripoli or the various rouges.
	Soft textured finish of parallel scratch lines	M-3	Satin 120—140 grit (Coarse). Satin finishes have a texture and luster of less reflectivity than buffed finishes. They result from fine parallel scratch lines being formed on a surface.
		M-4	Satin 140—180 grit (Medium).
		M-5	Satin 180—220 grit (Fine).
		M-6	Hand rubbed with steel wool. A satin finish applied by rubbing first with coarse steel wool or abrasive paper to remove die lines and scratches and finally with #0 stainless steel wool lubricated with neutral soap.
		M-7	Brushed with wire wheel. Preferably applied over a fine or medium sand blast, this finish has a smooth matte appearance.
		M-8	Satin finish produced with a rotary wheel having individual strips of coated abrasive cloth, used especially for finishing contoured surfaces.
	Pleasing rough texture used primarily for exterior applications (See Note 5)	M-9	Sand blast 16-20 mesh (coarse matte finish). Minimum metal thickness normally ⅛″.
		M-10	Sand-blast finish 40-50 mesh (medium matte finish). Minimum metal thickness normally ⅛″.
		M-11	Sand-blast finish 100-200 mesh (fine matte finish). Thin sheet may warp slightly during blasting, but warping can generally be avoided by uniform blasting on both sides of the material.
		M-12	Shot blast. The appearance of this finish is dependent on the size and type of shot and the velocity.
Chemical finish (See Notes 1 and 3)		C-1	Chemical etch. (Degree of etch controlled by time and solution, either sodium hydroxide or sodium hydroxide and sodium fluoride)
Chemical coatings		CC-1	Used for exterior protection and decoration as well as pre-paint treatment, such as: Alodine by American Chemical Paint Co., or Bonderite by Parker Rust Proof.
Anodic coatings (See Notes 1, 2 and 4)		A-1	Clear finish. 30 minute anodizing time in 15% sulphuric acid bath. Average coating thickness: 0.0004″—Average coating weight: 17 mg/sq. in.
		A-2	Clear finish. 60 minute anodizing time in 15% sulphuric acid bath. Average coating thickness: 0.0008″—Average coating weight: 35 mg/sq. in.
Applied coatings		AP-1	Paints, lacquers or enamels applied to any properly prepared surface.
		AP-2	Porcelain enamel.
Special finishes		S	Any finishes not covered above, such as hammered mechanical finish.
		NOTES:	1. For protection during construction, it is recommended that these finishes be given a coat of water-white methacrylate lacquer after fabrication. 2. For maintained exterior applications a minimum anodic film thickness of 0.0004″ is recommended. For severe industrial, marine, or high humidity environments, and for unmaintained exterior surfaces, a minimum anodic film thickness of 0.0008″ is recommended. 3. These finishes eliminate the variations of the natural finish. They may be used as final finishes, with a suitable temporary protection, or as preliminary surface treatments for subsequent protective or decorative finishes. 4. Following are suggested tests for anodic coatings: (1) thickness measurements in accordance with ASTM B244-49T; (2) coating weight measurements in accordance with ASTM B137-45; (3) sealing test in accordance with ASTM B136-45. 5. Sand-blast finishes turn gray when anodized unless aluminum oxide grit is used instead of sand, or an etch treatment precedes anodizing.

CHEMICAL ETCH FINISHES

Sparkling, frosted surfaces or bright, lightly etched surfaces are produced by alkaline or acid reagents. The etching treatments are usually followed by immersion of the metal in a solution of equal parts, by weight, of nitric acid and water. Chemical etches can be used to reflect light diffusely, or for ornamentation.

To protect chemically etched finishes prior to and during construction, it is recommended that they be given two coats of water-white methacrylate lacquer.

CHEMICAL CONVERSION COATINGS

Chemicals can be used to produce reactions that change aluminum surfaces to compounds of aluminum—usually oxides, phosphates, fluorides or chromates of aluminum. Chromate films provide additional corrosion resistance. Chemical conversion coatings provide an excellent base for painting.

ANODIC (ELECTROCHEMICAL) FINISHES

Anodizing produces a film of hard aluminum oxide which enhances surface appearance, increases resistance to corrosion or abrasion. This film provides an excellent protective coating for etched or mechanically finished surfaces, accurately reproduces the texture of the underlying surface.

Anodizing is an electrolytic process whereby a coating of aluminum oxide is created on an aluminum surface. The material to be anodized is placed in an electrolyte solution, usually with a sulfuric acid base, and an electric current is passed through the solution. The process gets its name from the fact that the material to be coated functions as an anode, the positive terminal in an electrolytic action. The current breaks down the acid solution, releasing free oxygen, which combines electrolytically with the aluminum to form a surface oxide. Anodizing, in effect, is an accelerated oxidation process. The thickness of the anodic coating depends upon the time in the anodizing bath.

A colorfast range of shades of gray and gold can be produced for architectural sheet and extrusions, as discussed on page 13. For interior applications dyed anodic oxide films can provide a variety of lustrous colors. For more comprehensive information on color anodizing, the Kaiser Aluminum architectural representative should be consulted. Samples of colorfast gray and gold anodized aluminum are available to aid in specifying. Consistent uniformity of color in the anodizing of Kaiser Aluminum architectural alloys may be assured by means of the photovolt reflectometer. This is a photosensitive instrument that registers differences in color intensity by detecting differences in the amount of reflection from a surface lighted by a controlled light source, in comparison with light reflected from a standard white surface.

Highly accurate readings are possible, far beyond the perception of the eye. Samples should be continually checked during the anodizing process to make certain that color values are constant.

Anodic finishes should be protected prior to and during construction with a double coat of water-white methacrylate lacquer.

PAINT, LACQUER, ENAMEL FINISHES

A limitless variety of colors are available for painting, lacquering or enameling aluminum. The types of finishes and material should be selected in cooperation with the paint manufacturer. Excellent results can be obtained with baked enamel finishes.

PORCELAIN ENAMELED FINISH

Few materials available today offer the architect as many design possibilities as colorful, durable porcelain enameled aluminum. Porcelain enameled aluminum, in flat or formed sheet or in extruded shapes, meets the increasing demand for colorful exterior finishes, offers a wide range of colors and textures, from high gloss to full matte finish. Colors are durable—won't peel, won't fade; they retain their uniformity for years.

Porcelain enamel on aluminum has a hard, impervious, glassy surface fused to the metal base. The finish resists the most severe weather conditions, salt air, industrial atmospheres and extremes of temperature.

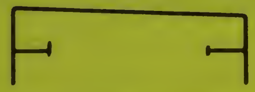
Kaiser Aluminum produces a number of semi-fabricated products for use in architectural applications. These are covered here briefly.

OTHER KAISER ALUMINUM ARCHITECTURAL PRODUCTS

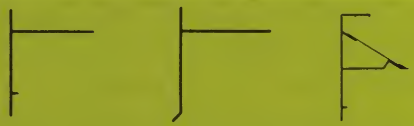
STANDARD ARCHITECTURAL EXTRUSIONS

Comprehensive information on these standard extrusions will be found in the Kaiser Aluminum publications, "Copings and Gravel Stops," A.I.A. 15-L, "Thresholds and Window Sills," A.I.A. 14-B, and "Ornamental Extrusions," A.I.A. 15-L.

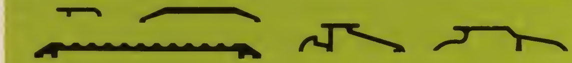
Copings—extruded shapes for preventing weather damage to walls in flat-roof construction in widths 14″ and 9½″, for 12″ and 8″ walls. Kaiser Aluminum copings are provided with necessary accessories for firm anchoring and watertight joints. Alloy 6063-T42, standard lengths 9′-10″.



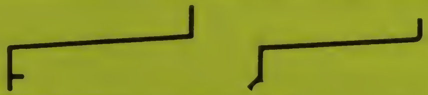
Gravel stops—three types of extruded shapes, provide a flush line at the roof edge to meet the needs of contemporary architecture. They are fabricated in 4″ widths and a selection of face dimensions. Accessories are provided for proper watertight installation. Alloy 6063-T42, standard lengths 9′-11½″.



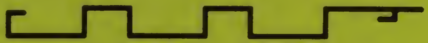
Thresholds—extruded shapes to meet a wide variety of doorway floor conditions. Widths from 1½″ to 7½″. Alloy 6063-T5, standard lengths 16′-3″.



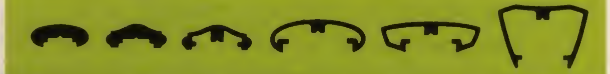
Window sills—extruded shapes for use chiefly with masonry walls. Available in widths from 2⅛″ to 8¼″. Usable with aluminum, steel or wood windows. Alloy 6063-T42, standard lengths 20′-0″.



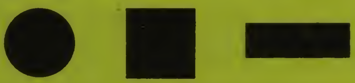
Facing system—seven basic interlocking components adaptable to any type of wall, any length of wall, interior or exterior. Graceful design alternating shallow channels (¾″ wide) with raised flats (1½″ wide). Provided with fastening accessories. Alloy 6063-T42, standard lengths 16′-0″.



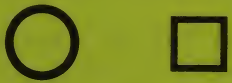
Handrails—ornamental extruded sections for wall or balustrade mounting. Six standard sections. Alloy 6063-T5, standard lengths 20′-0″.



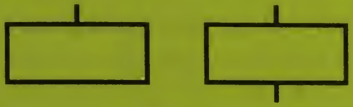
Rod and bar—extruded sections for many architectural uses. Rod diameters ½″ to 1″; square bar from ⅜″ to 1½″; rectangular bar thicknesses ⅛″ to 1″, widths ½″ to 3″. Alloy 6063-T5, standard lengths 16′-0″.



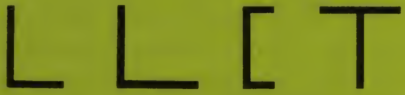
Pipe and square tube—extruded sections for handrails and other architectural uses. Pipe nominal diameters ⅜″ to 4″. Alloy 6063-T6, standard lengths 20′-0″. Square tube ¾″ to 2″. Alloy 6063-T5, standard lengths 21′-1″.



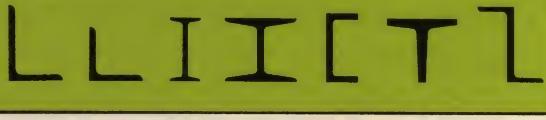
Rectangular and finned tube—extruded sections for door jambs, window mullions, other architectural uses. Rectangular tube thicknesses ½″ to 2″, widths 1″ to 5″; finned tube 1¾x4″ only, with one or two ½″ fins. Alloy 6063-T5, standard lengths 21′-1″.



Architectural shapes—sharp-corner angles, channels and tees, extruded shapes for many architectural applications. Angle legs up to 3½″, channel webs up to 5″, tees up to 1¼″ depth. Alloy 6063-T5, standard lengths 16′-0″ (some channels 20′-0″).



Structural shapes—angles, channels, beams, tees and zees, extruded shapes for many architectural and structural applications. Angle legs up to 4″, channel webs up to 8″, I-beam webs up to 6″, H beams 4x4″, tees to 2″ depth, zees to 3″ depth. Alloy 6061-T6, standard lengths to 25′-0″.



Other products include Kaiser Aluminum domes, domed shells employing a combination of geodesic and stressed-skin principles; ShadeScreen, a louvered screening that effectively blocks out the hottest rays of the sun as well as insects; electrical conductor, bus bar and conduit in all sizes for all electrical uses; and industrial roofing and siding.

Flint Medical Arts Building, Flint, Michigan. Architect: Brice McMillen, A.I.A. General contractor: Sorensen-Gross Construction Co. Aluminum subcontractor: Koert's Glass & Paint Co. Aluminum components: Kaiser Aluminum standard architectural extrusions

Kaiser Aluminum Dome, American National Exhibition Buildings, Sokolniki Park, Moscow, Russia. Architects: Welton Becket, F.A.I.A., & Associates. Aluminum dome subcontractor: Lydick Roofing Co.

(Note to Specification Writer: A separate section is recommended for all architectural aluminum work, instead of including it under several other sections. This will make a better specification, conducive to more accurate bidding by sub-contractors. Other metalwork sections should refer to this section.)

SUGGESTED SPECIFICATIONS

ARCHITECTURAL ALUMINUM SECTION

-01 GENERAL CONDITIONS

"The General Conditions of the Contract for the Construction of Buildings," (*) standard form of the American Institute of Architects, current edition, are part of this specification.
**(And "Supplementary General Conditions")*

-02 SCOPE OF WORK

A. Work Included—Furnish all labor, materials and equipment to complete the fabrication and erection of all aluminum work shown on the drawings, or herein specified as follows:
(Aluminum items being used should be listed here by product name, type, or part number.)
Miscellaneous fasteners, anchors, brackets, straps, plates and inserts required in connection with the work of this section.
Protective coatings.
Caulking, grouting and sealing required in connection with the work of this section.
Final cleaning.

B. Work Not Included—*(All items to be excluded from this section should be listed here together with section under which they are specified.)*

-03 MATERIALS

All aluminum alloys specified herein shall be as produced by Kaiser Aluminum & Chemical Corporation. *(The selection of an aluminum alloy is important and depends largely on the form in which it will be used, such as sheet and plate, extrusions or castings, as well as the mechanical properties, color matching and finishing characteristics desired. Your Kaiser Aluminum Architectural representative will gladly assist you in the selection of the proper alloy, or you may refer to the Table on "Kaiser Aluminum Architectural Alloys," pages 6 and 7.)*

A. Sheet Aluminum—*(List applications and specify alloy, thickness and temper.)*

B. Extruded Aluminum—*(List applications and specify alloy, thickness and temper.)*

C. Cast Aluminum—*(List application and specify alloy and minimum thickness.)*

D. Fasteners

1. Aluminum Screw Machine Products—*(Specify alloy.)*
2. Aluminum Nuts—*(Specify alloy.)*
3. Aluminum Rivets—*(Specify alloy.)*

E. Anchors—All anchors, other than aluminum shapes, shall be hot dip galvanized or zinc plated after fabrication.

F. Caulking Compound—Approved non-staining, permanently elastic, waterproof type colored aluminum (6).

-04 FINISHES

Finishes on exposed surfaces shall be as indicated on the drawings and/or herein specified, and in accordance with the following procedures:
(A wide variety of finishes may be specified for architectural aluminum such as Mill Finish or Natural, Mechanical Finishes, Chemical Finishes, Anodic Finishes, Coated Finishes, or a combination of the Mill, Mechanical, Chemical, and Anodic Finishes. Specify the finish desired from the table on page 19, or select a finish and procedure specification from the sample portfolio of Kaiser Aluminum Architectural Finishes.)

-05 SAMPLES

Submit for the approval of the architect duplicate samples of materials with surface preparation and finishes as specified. Samples shall be representative of the materials to be used on the project, and all materials installed shall match the approved samples.

-06 SHOP DRAWINGS

Before executing any of the work in this section, submit prints of shop drawings for approval by the architect. Drawings shall show dimensions, sizes, thicknesses, gauges, materials, finishes, joining, attachments, and relationship of work of this section to adjoining construction. All work shall be fabricated and erected in accordance with the approved drawings.

-07 EXPANSION AND CONTRACTION

Aluminum work shall be designed and anchored so there will be no objectionable distortion, nor the fastenings seriously stressed as the metal expands and contracts.

Expansion joints shall be located as shown and shall be designed and constructed so as to be watertight.

(Architectural aluminum alloys have a coefficient of thermal expansion of 0,000013/degree F/unit of length.)

(Example: A piece of aluminum 20 ft. long will expand or contract 0.312" or approximately 5/16" in a 100° F temperature change.)

-08 PROTECTION OF CONTACT SURFACES

A. Dissimilar Metals—Where aluminum materials are placed in contact with or fastened to dissimilar metals, with the exception of stainless steel or zinc, the surfaces shall be—

given a heavy brush coat of zinc chromate primer made with a synthetic resin vehicle (1), followed by two coats of aluminum metal and masonry paint (5).

or

given a heavy brush coat of alkali-resistant bituminous paint (2),

or

separated with a non-absorptive tape or gasket.

B. Masonry or Plaster—Where aluminum materials are placed in contact with, or built into, masonry or plaster, they shall be given a heavy brush coat of alkali-resistant bituminous paint (2) or clear methacrylate lacquer (3).

C. Wood—Where aluminum materials are placed in contact with green or wet wood, or any other absorptive material subject to repeated wetting, or wood treated with a noncompatible preservative (4), the contact surfaces shall be—

given a heavy brush coat of aluminum pigmented bituminous paint,

or

given two coats of aluminum metal and masonry paint (5),

or

given two coats of aluminum house paint. Seal joints with approved caulking material.

(Dissimilar metals should be painted if drainage from them passes over aluminum work.)

(1) zinc chromate primer made with a synthetic resin vehicle:
Benj. Moore, Inc.—Ironclad Zinc Chromate Primer
duPont-77-3 Zinc Chromate Primer
National Lead Company—041 Zinc Chromate Primer
Pittsburgh Plate Glass—17-6 Zinc Chromate Primer
Sherwin-Williams—E90Y3 Zinc Chromate Primer
(2) alkali-resistant bituminous paint:
Koppers Chemical Company
Pittsburgh Coke & Chemical Company
(few manufacturers have trade names of this product)
(3) clear methacrylate lacquer:
duPont—1234 Clear Acrylic Lacquer
National Lead Company—C8560 Clear Aluminum Coating
Sherwin-Williams—SSA Lacquer, Clear T1C189
(4) non-compatible preservatives: (unfriendly to aluminum)
Chapman Chemical Company—Chapman's W. R.
National Lead Company—70-90 Wood Preservative
Pittsburgh Plate Glass—Seal Treat
Acceptable wood preservatives: (friendly to aluminum)
Pentachlorophenol solutions . . . Wolman salts . . . Creosote . . . Zinc Naphthanate
(5) aluminum metal and masonry paint:
Benj. Moore, Inc.—Weather Proof Aluminum
duPont—977 Aluminum Paint Ready Mixed
National Lead Company—29-02 Ready Mixed Aluminum
Pittsburgh Plate Glass—22-3 Metaleaf
Sherwin-Williams Company—B59SI Aluminum Silver-Brite
(6) caulking compounds:
Parr Paint and Color—Alumilastic
Minnesota Mining—EC 899

-09 WORKMANSHIP

Aluminum work shall be fabricated in a shop where quality of work is in accordance with the highest standards for work of this type. All work shall be executed by mechanics skilled in the fabrication of aluminum, and shall be true to detail with sharp, clean profiles, fitted with proper joints and intersections, and with finishes as specified.

(Additional paragraphs covering specific products or applications may be included under this clause.)

-10 ERECTION

All work shall be erected plumb, level, square and in proper alignment and relationship to work of other trades. Work shall be free from waves, buckles, sags or other defects. Anchors shall be as shown on the drawings to provide secure anchorage for all parts of the work.

Erection shall be executed by highly skilled mechanics and in accordance with the highest standards for work of this type.

-11 PROTECTION AND CLEANING

Adequate protection shall be provided during fabrication, shipment, site storage and erection to prevent damage to the finished work due to stains, discoloration, scratches, or any other cause. After erection, all work shall be cleaned of protective materials and surface blemishes by—*(select one)*

the general contractor

or

aluminum contractor

or

cleaning contractor

In accordance with recommendations in Kaiser Aluminum publication "Care, Cleaning and Maintenance of Architectural Aluminum" and left in a condition satisfactory to the architect.

OTHER KAISER ALUMINUM LITERATURE

Additional literature, which may be valuable as complementary reference material, includes the following:

- Care, Cleaning and Maintenance of Architectural Aluminum
- Finishes for Architectural Aluminum

Other Kaiser Aluminum literature can be found elsewhere in Sweet's, as indicated in the chart below. All of the items listed can be obtained from your Kaiser Aluminum representative—or write to Kaiser Aluminum & Chemical Sales, Inc., Architect's Service Department, 1924 Broadway, Oakland 12, California.

Title	Where to find it in Sweet's	
	Architectural File	Industrial Construction File
Thresholds and Window Sills Extruded shapes to meet a wide variety of interior and exterior doorway and floor conditions.	$\frac{19b}{Ka}$	
Ornamental Extrusions Facing system, ornamental handrails, angles, channels, beams, rod, bar, pipe, tube and other standard extruded shapes for architectural use.	$\frac{6a}{Kai}$	
Copings and Gravel Stops Extruded shapes for flat-roof coping protection and for curbing gravel on built-up roofs.	$\frac{8b}{Kai}$	$\frac{8g}{Kai}$
Industrial Roofing and Siding Aluminum ribbed, v-beam and corrugated roofing and siding in variety of sizes and thicknesses; also its use in insulated sandwich-wall construction.	$\frac{8b}{Ka}$	$\frac{8b}{Ka}$

KAISER ALUMINUM & CHEMICAL SALES, INC.

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First National Tower
Phone: Blackstone 3-6105

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55 Marietta Street N.W.
Phone: Jackson 3-1903

BALTIMORE, MARYLAND
7215 York Road
Phone: VAlley 5-9033

BIRMINGHAM, ALABAMA
1206 20th Street South
Phone Alpine 2-5196

BOSTON 16, MASSACHUSETTS
20 Providence Street
Phone: Hancock 6-7255

BUFFALO 22, NEW YORK
257 Elmwood Ave.
Phone: Elmwood 9050

CHARLOTTE, NORTH CAROLINA
129 West Trade St.
Phone: FRanklin 5-7358

CHICAGO 1, ILLINOIS
360 North Michigan Avenue
Phone: Dearborn 2-5080

CINCINNATI 6, OHIO
2330 Victory Parkway
Capital 1-5550

CLEVELAND 13, OHIO
55 Public Square
Phone: Superior 1-3000

COLUMBUS, OHIO
395 E. Broad St.
Phone: Capital 1-5539

DALLAS 1, TEXAS
1712 Commerce Street
Phone: Riverside 7-1501

DAVENPORT, IOWA
220 Main Street
Phone: 3-8005

DAYTON, OHIO
349 West First Street Bldg.
Phone: Baldwin 4-0317

DENVER, COLORADO
655 Broadway
Phone: Alpine 5-3459

DETROIT 2, MICHIGAN
7700 Second Ave.
Phone: Trinity 3-8000

GRAND RAPIDS 2, MICHIGAN
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Phone: Glendale 6-8601

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95 Woodland St.
Phone: CHapel 6-7421

HOUSTON 2, TEXAS
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Phone: Jackson 3-5518

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Phone: Melrose 4-8311

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Phone: Valentine 1-3780

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823-3 Commonwealth Bldg.
Fourth & Broadway
Phone: Juniper 4-2114

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Phone: FAirfax 3-8549

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Phone: Newton 3-3431

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Phone: West 3-5864

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Phone Walnut 7-8728

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Phone: York 47-1028

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4005 Hillman St.
Phone: Sterling 8-2441

EXPORT OFFICE: 1924 Broadway, Oakland 12, California WASHINGTON OFFICE: 1625 Eye Street, Washington, D. C.

KAISER ALUMINUM

ARCHITECT'S SERVICE

Kaiser Aluminum architectural representatives work closely with architects and fabricators throughout the country to help them receive the maximum benefits of designing in aluminum. This service is available to any architect interested in finding out more about this versatile metal. For details contact your nearest Kaiser Aluminum sales office.

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